

Exploratory Analysis of Project Management Adoption and Maturity Level of IT Companies—A Comparison between Macao and Hengqin

Ka Seng Wong¹ and João Alexandre Lobo Marques^{2*}

¹ Faculty of Business and Law, University of Saint Joseph, Macau, China; Email: wong.ka.seng@usj.edu.mo (K.S.W.)

² Laboratory of Applied Neurosciences, Faculty of Business and Law, University of Saint Joseph, Macau, China

* Corresponding author: alexandre.lobo@usj.edu (J. A. L. M.)

Abstract—The Project Management Maturity Model (PMMM) is a framework that helps organizations assess their project management capabilities and identify areas for improvement, based on the idea that project management processes and practices can be developed and improved over time. Organizations can move through different maturity levels as they develop their project management capabilities. This work aims to provide a comparative analysis of project management maturity considering IT companies from Macao and Hengqin, to understand the importance IT project managers, identify weaknesses, and provide suggestions to improve the management skills in organizations from these two areas. A survey is conducted among 34 Project Managers from both areas, with technical and demographic questions. A share of 80% and 62% of participants identified low maturity level in Macao and Hengqin, respectively. Notably, 23% of Hengqin participants selected the highest maturity level, and no one selected this level in Macao. The ten management areas are also assessed. As output, a series of recommendations are proposed to the IT project managers from Macao and Hengqin to elevate the local maturity level on both areas. Firstly, the project managers working in Macao should consider creating and documenting basic processes related with scheduling; analyze possible constraints related to resource management; clearly outline roles and responsibilities; establish standard communication processes with stakeholders. Finally, project managers working in Hengqin should increase efforts to maintain the higher maturity level of cost and resource management; increase communication management processes, and engage management staff involved in changes that impact the triple constraints.

Keywords—Project Management, Maturity Level, Macao, Hengqin

I. INTRODUCTION

Projects are temporary works performed to create a unique product, service, or result (Project Management Institute, 2017) and are necessary work in modern society. Good management is essential if the project is to be successful. The so-called project management is to maximize the realization of the project's purpose by effectively using the money, time, and resources provided by the project owner to achieve the project's original purpose.

Effective project management requires strong leadership, communication, and organizational skills. Project managers must be able to manage multiple tasks and stakeholders, identify and manage risks, and adapt to changing circumstances. They must also be able to motivate and manage project team members, resolve conflicts, and communicate effectively with stakeholders.

With the widespread use of project management methods, people gradually want to know whether their management capabilities or shortcomings are good enough for other competitors. Therefore, a tool for measuring project management capabilities is needed to objectively evaluate its capabilities, the advantages and disadvantages of the industry, and provide a certain degree of comparison with the best practice in the industry. The Project Management Maturity Model (PMMM) is introduced. The PMMM is a framework that helps organizations assess their project management capabilities and identify areas for improvement (Crawford & Pollack, 2007). The PMMM is based on the idea that project management processes and practices can be developed and improved over time. Organizations can move through different maturity levels as they develop their project management capabilities.

By using the PMMM to assess their project management capabilities, organizations can identify areas of strength and weakness and develop a plan for improving their project management processes and practices. The PMMM provides a roadmap for organizations to follow as they develop their project management capabilities and helps them to identify the specific steps they need to take to improve their project management practices. It enables organizations to continuously improve their project management capabilities and ensure their practices align with their strategic goals and objectives.

Like all types of projects, IT projects also need appropriate management methods to complete the purpose of project establishment efficiently. However, IT projects have some unique characteristics that distinguish them from other types of projects, such as technical complexity, quickly changing technology, tight deadlines, multiple stakeholders, integrations, and others (Schwalbe,

2015). Therefore, IT projects are riskier than other types of projects.

This work aims to provide a comparative analysis of project management maturity considering IT companies from Macau and Hengqin. In addition, to understand the importance IT project managers and organizations place on project management. In addition, it identifies weaknesses in project management and provides suggestions to improve the management skill of Macau and HengQin organizations.

II. LITERATURE REVIEW

A. The Project Management Maturity Model

The project management maturity model is a concept that aims to provide an evaluation and improvement framework for the improvement of the organization's project management capability. It describes an organization's general stages, from a chaotic, immature state to an institutionalized, mature state in project management. Usually, the maturity model also divides the entire evolution process into several stages, continuously improving the organization's project management maturity and gradually accumulating its project management level. The maturity divides into five levels; the first level is the initial process-The organization does not have practices or standards for implementing project management processes; the second level is structured process and standards - Many project management processes are established within the organization but are not considered standards; the third level is organizational standards and Institutionalized Process-All project management processes are in place and have become the organization's project management standards; The fourth level is Managed Process - Project management will consider the execution efficiency of some projects in the past and measure how to optimize in the future. Management makes decisions by using efficiency and effectiveness indicators; the last level is the Optimizing Process-A process for improving project management activities has been established. All lessons learned are regularly reviewed and used to improve project management processes, standards, and documentation. Management is concerned with continuous improvement in addition to effective project management.

Companies can identify their project management strengths and weaknesses using the maturity models. By solving the problems in project management and forming and implementing improvement strategies, the project management level of the organization can be steadily improved, and the project management ability of the organization can be continuously improved (Rosenstock, *et al.*, 2000). It can also satisfy organizations to understand whether their project management processes are adequate (Hillson, 2003) and available to decide to implement an improvement plan based on the development strategy. Organizations can also conduct horizontal comparisons with companies in the same or

similar industries [6] to determine the direction of improvement in project management.

B. The Problems of the Project Maturity Model

Although the project management maturity model has several benefits, it also has problems on the other hand. Several different maturity models exist, meaning no one is widely accepted as a standard. As stated by Ibbs & Kwak, there is no generally accepted methodology or well-defined process to fairly measure project management practices in any organization or across industries (Ibbs and Kwak, 2000). As a result, many companies have problems implementing or improving their project management processes. In addition, each model's evaluation does not consider the type of project. The project management processes required for various types of projects may not be exactly the same. Thus, no single model provides universal indicators of success across industries and different types of projects (Grobler & Steyn, 2006). In addition, to execute an efficient project not only needs to deal with the constraints of the project but also needs to understand the organization's characteristics. However, these models usually do not consider firm characteristics (Bolat *et al.*, 2017). As a result, it may mislead the organization toward improvement. The management of the organization needs to have a deep understanding of the characteristics of the organization before it is possible to set a more appropriate improvement plan.

Finally, it is challenging for organizations to choose the appropriate model or standard for assessment. The shortcomings are also quite noticeable because some models are relatively complete and include more factors than others. Including its complexity in assessment, it is not easy to use for horizontal comparison of project management of the same type of organization.

C. IT Project in Macau and Hengqin

As mentioned earlier, IT projects are used in various industries to strengthen or improve their operational efficiency. Macau and Hengqin are also implementing various IT projects to provide better services for citizens or enterprises. In recent years, the Government of Macau Special Administrative Region has actively proposed information technology and other related developments; the main goal is to build Macau into a smart city. The most obvious one related to people's livelihood can be regarded as the bus tracking system. The system can monitor the status of all buses on the road in real time, and citizens can check the frequency and status of buses through their mobile app. In addition, bus operators can also change their bus schedules based on the number of passengers to facilitate citizens to plan their arrangements. In terms of public security, the Public Security Police has implemented and improved its sky-eye system, installed cameras in various places in the urban area, monitored the streets, and vigorously deterred the occurrence of crimes.

Hengqin is also actively under construction. In addition to infrastructure-related projects being carried out in Hengqin, other information technology-related

systems are also being implemented step by step. For example, China's first financial service platform for Portuguese-speaking countries launched in Hengqin was proposed. This project provides financial services for Portuguese-speaking countries and provides customers with innovative financial services integrating online and offline.

Of course, the IT projects in Macau and Hengqin are not limited to the above. There are also some cooperation projects between the two places, such as the comprehensive management system for vehicles entering and leaving Hengqin in Macau. Car owners in Macau can use this system to apply for their vehicles to travel between Hengqin and Macau unconditionally, which significantly facilitates the residents of Macau to work or do business in Hengqin. Moreover, the Chinese government intends to develop new industries for Hengqin, including technology research and development and high-end manufacturing. In the future, Hengqin and Macau will have more research and development and practical projects related to information technology which will improve efficiency and open the door for residents of the two places.

III. METHODOLOGY

A. Method

This study conducted survey research to collect data for the IT manager and analyze it to identify patterns and relationships between variables. The methodology proposed in this research follows a quantitative analysis approach. A survey was created and distributed online to collect data from the IT project manager. The designed survey was divided into three parts, in addition to questions for the demographic. The first part of the survey is the general information about the participant; the purpose of this part is to gather the background of the participants; the second part is about the project management process adaptation in their project; the questions in this part are based on the project management maturity model by Craw J. K. The aim is to understand the application of project management processes in each knowledge area and some essential components; the last part is the perspectives on the project manager and other related activities; This part aims to understand participants' views on project managers and related project management activities. The survey included multiple-choice questions, which is a Likert-scale format with five items, the first item is the worst, and the fifth item is the best.

B. Sampling Strategy

The population sampling was focused on the project managers working in Macau or HengQin from multiple industries working with IT projects. In order to conduct survey research, the researcher invited groups of people from Macau and HQ from multiple industries working with IT project management as convenience sampling.

The survey was distributed online through an instant message app and email to IT project managers working in

these two areas following a judgement sampling with known specialists in the area, followed by snow balling among peers. A total of 34 IT project managers fully responded to the questionnaire (valid surveys). Since there is no official statistical report on the number of project managers working in Macau or Hengqin, according to the authors' experience following the industry, there are several project managers in Macau and Hengqin in general, but not many project managers working in the IT industry. Moreover, there may be fewer who can understand what project management maturity is; therefore, 34 participants can be considered a valid sample size to obtain an initial understanding of the acceptance and adaptation of the project management framework.

IV. RESULTS AND RECOMMENDATIONS

A. Demographics Overview

A total of 34 people responded to this survey online, including those who had worked as project managers in IT companies in Macau and Hengqin. The coverage ranged from 21 to 50 years old and included people with different educational levels. Some have just entered the IT industry, while others have worked for over fifteen years. Some are still working as project managers, some have been upgraded to become project owners, but many have returned to the project execution level. Most of them do not have certificates related to project management, but they know what project management is.

B. The Maturity between Macau and Hengqin

First, the most important element of project management is the triple constraints of project management, which are cost, schedule, and resources. Regarding schedule management, Fig. 1 shows that over 80% of participants selected maturity 1 and 2 in Macau, and only 62% of participants from HengQin selected the same maturity level. Notably, 23% of Hengqin participants selected the highest maturity level, and no one selected this level in Macau.

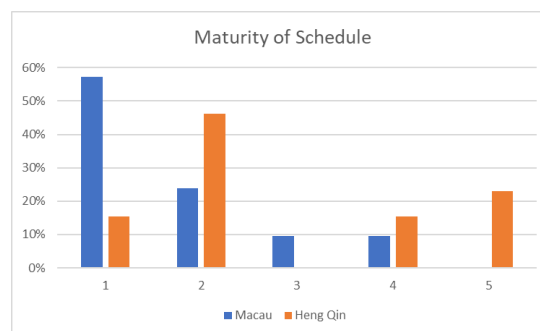


Figure 1. The Maturity of the Schedule Between Macau and Hengqin

Similar results happen in cost management, 76% in Macau and 46% in HengQin selected maturity 1 and 2 exhibited in Fig. 2.

In Fig. 3, only 20% of Macau participants selected the top 2 maturity levels, and over 50% of HengQin participants selected these levels.

From the result, we can roughly know that the project managers in Macau are more casual than Hengqin in managing the triple constraints of the project. The project managers in Macau are more likely to manage these elements without establishing a standard management process.

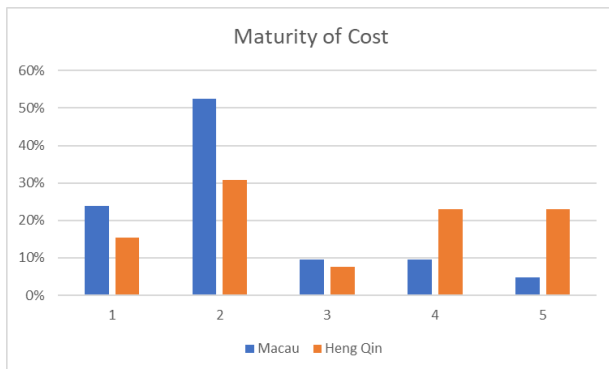


Figure 2. The Maturity of the Cost Between Macau and Hengqin

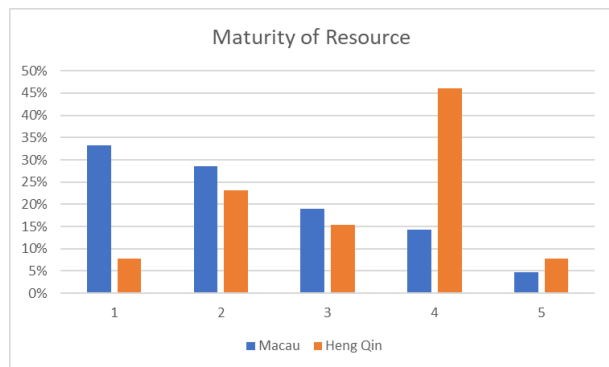


Figure 3. The Maturity of the Resource Between Macau and Hengqin

Second, successful projects require effective communication and stakeholder involvement. Therefore, it is necessary to compare the maturity level of project communication and stakeholder management in Macau and Hengqin.

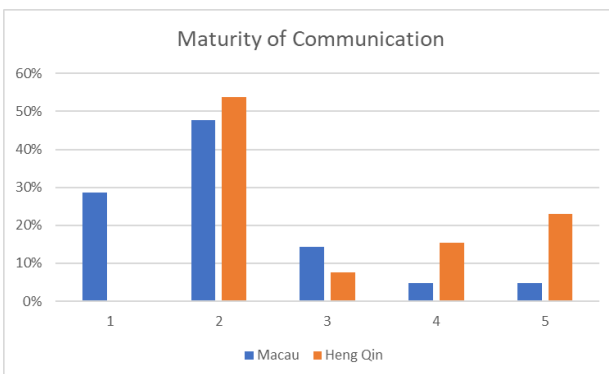


Figure 4. The Maturity of the Communication Between Macau and Hengqin

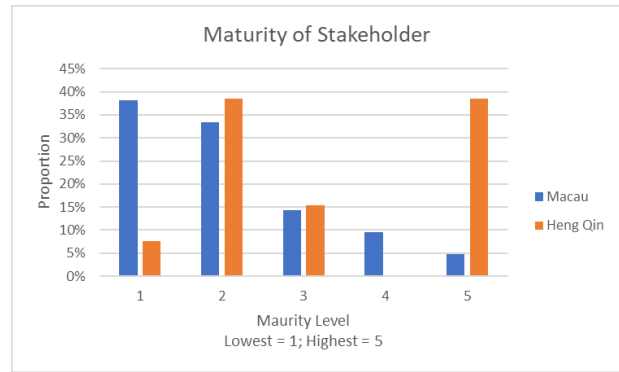


Figure 5. The Maturity of the Stakeholder Between Macau and Hengqin

For communication management, 29% of participants selected maturity level 1 in Macau. However, 23% of participants selected the highest maturity level in Hengqin, as shown in Fig. 4. There are apparent differences in communication management between the two places. As for stakeholder management shown in Fig. 5, there are similar results, 38% of participants selected maturity level 1 in Macau, and 38% of participants selected the highest maturity level in Hengqin. From the above data, it can be seen that Macau does not have a standard communication and stakeholder management process. Project managers can manage the relationship according to their strengths and relation. On the contrary, Hengqin can have a mature process to ensure effective communication and stakeholder engagement.

C. Recommendations to Macau's Project Manager

With a total of 62% of the respondents, recommendations to Macau's Project Managers according to the analyzed data may improve the current scenario and move the IT Industry to a higher maturity level.

The majority of project managers from Macau indicated that the schedule and resources management process is ad-hoc, which is the lowest maturity. The schedule management does not have a standard project scheduling and planning process. Same as planning and staffing. Poor scheduling may cause regular delays in the project.

In light of this, establishing standard schedule management processes is important. The project managers consider creating and documenting all basic processes for scheduling the project; for example, the scope statement is used to construct the WBS and, based on the created WBS, to develop the project schedule (Crawford, 2021). Regarding the resources processes, the project managers need to analyze possible constraints in obtaining needed resources and develop a response. Also, describe the responsibilities of each project participant.

In addition, the maturity level of communication and stakeholder management is relatively low. Therefore, the project managers must define a standard process to communicate with each stakeholder and deliver the necessary information. The project performance reporting needs to have standard content, such as histograms and tables accompanying the narrative report of project status.

A standard approach needs to establish to manage and engage the stakeholders.

In addition, Macau's project managers may improve the maturity level in scheduling, planning, and communication management with the following recommendations:

- Creating and documenting all basic processes involved in scheduling a project
- Analyzing possible constraints related to obtaining needed resources
- Outlining the responsibilities of each participant;
- Establish a standard process for communicating with stakeholders
- Analysis of the stakeholder and delivering the necessary information they need

D. Recommendations to Hengqin's Project Manager

For Hengqin, the maturity level can be considered high compared to Macau. In terms of cost maturity, almost 50% are at levels 4 and 5, and over 50% of resource maturity. It should be noted that, as mentioned in the previous chapter, a high level of maturity requires much effort to maintain (Albrecht & Spang, 2014). The high level of maturity requires the management of the enterprise to reasonably evaluate the balance between the efforts to maintain high maturity and the enterprise's efforts. Specifically for those IT companies, the sizing is not big enough.

The maturity level of communication could be enhanced from level 2 to level 3 by applying all the established communication management processes to all projects and engaging key management involved to approve all changes that impact the triple constraints.

The maturity level of Hengqin is relatively high in terms of cost and resources. Below are some additional recommendations for Hengqin's project manager:

- Evaluate the efforts to maintain the high maturity level of cost and resource management;
- Established communication management processes for all projects;
- Engaging key management involved to approve all changes that impact the triple constraints;

V. CONCLUSION

This study mainly distributed a series of questions related to the project management process to the project managers in Macau and Hengqin to answer. They made a self-assessment by reading each option in the questions. In addition, the survey also includes other views of the project manager on project management, and it is expected to obtain different perspectives.

The participants all answered the questions related to the project management process. More than half of the participants indicated that their procurement process could reach level 3 or above. In addition, half of the participants indicated that planning and resource management also reached level 3 or above. The above areas represent that the management process has reached a certain degree of preparation. On the contrary, the

maturity of change management is the worst performance in many areas; almost 80% of the participants indicated that their maturity level does not exceed level 3. The result means that change management does not apply a standardized process to control change.

The triple constraints of project management are essential elements that need to be managed effectively. The project managers in Macau tend to manage these elements casually without establishing a standard management process compared to their counterparts in Hengqin. Therefore, project managers everywhere must ensure they have robust processes in place to manage projects effectively.

Effective communication and stakeholder involvement is crucial for successful project implementation. Based on the comparison of maturity levels in Macau and Hengqin, it is evident that there are significant differences in communication management between the two places. The result indicates that Macau lacks a standardized process to manage stakeholders effectively. Project managers tend to handle relationships based on their strengths or personal relations with stakeholders instead. On the other hand, Hengqin has implemented mature processes to ensure efficient communication and stakeholder engagement throughout projects.

Future works may consider increasing the number of professionals in the data collection and also conducting focus groups on each project management area to identify gaps and challenges.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Wong Ka Seng performed the literature review, collected and analyzed the data, and draw the conclusions; João Alexandre Lobo Marques analyzed the data, designed and supervised the research and revised the document; all authors had approved the final version.

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